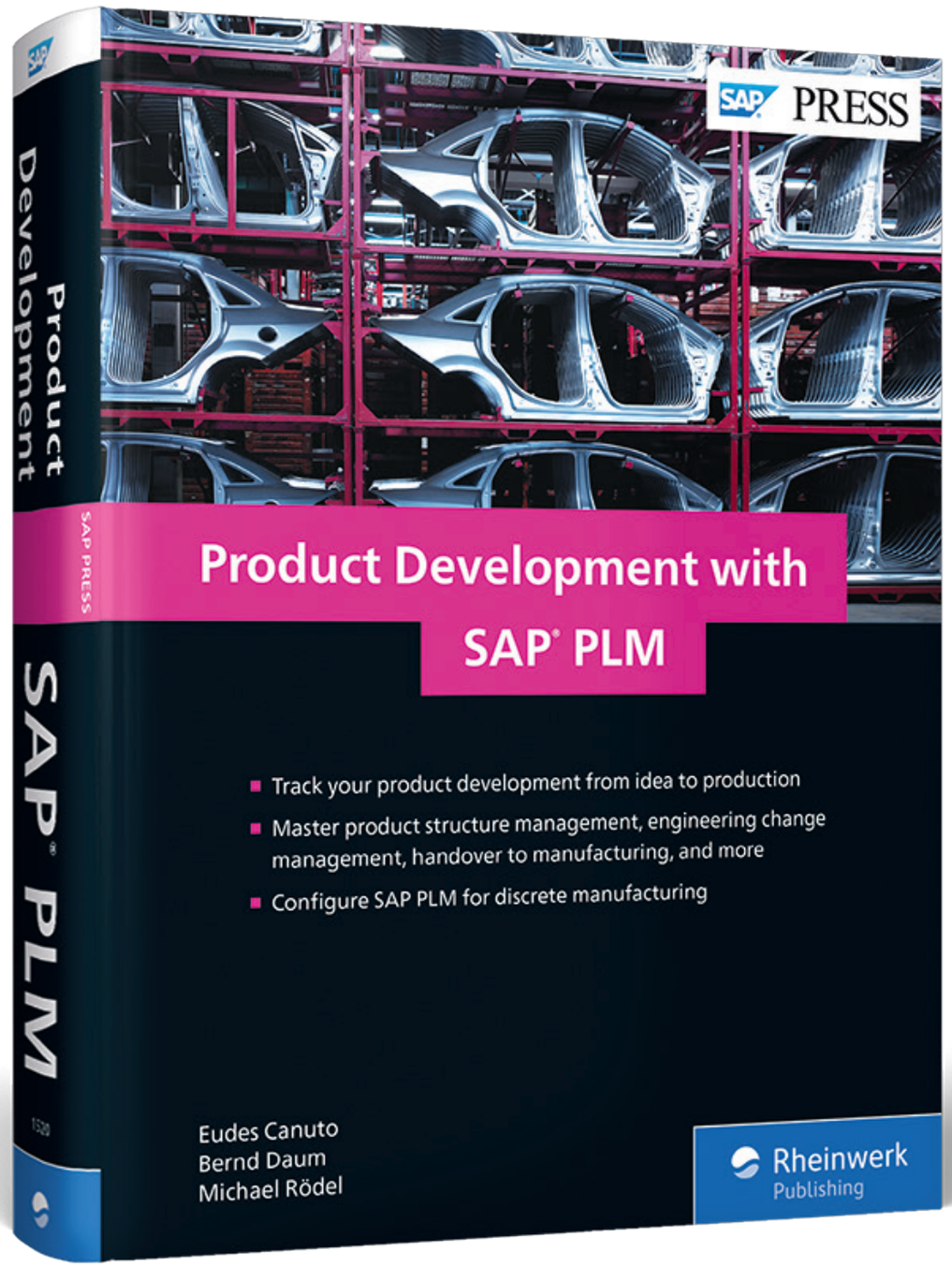
SAP PRESS
First-hand knowledge.
Rheinwerk Publishing



Reading Sample

This sample chapter describes the use of data objects within the product development process. It also covers SAP solutions for material management, document management, classification systems, and object search and navigation.

Eudes Canuto, Bernd Daum, and Michael Rödel
Product Development with SAP PLM
727 Pages, 2014, $89.95
ISBN 978-1-4932-1520-1
www.sap-press.com/4363

Chapter 2
Product Data

The continuous management of product data in product development ensures the quality of your products, optimizes the cycle times in product development, enables a better control of the product complexity, and increases product success.

During the product development process, information is generated that needs to be documented in a suitable manner. Structured management of this information provides the stakeholders involved in the product development with rapid and error-free access to the information necessary for their work. Product data management (PDM) provides the following functions:

- Manages the complexity of the product data and the process
- Avoids costly errors
- Improves decision-making in the product development process
- Creates a high-quality product

The key to the success of a new product is an efficient and structured data management system that enables quick use of data at an early stage in the process.

We will begin this chapter with an introduction to data objects within the product development process. In the following sections, we will present SAP solutions for the following areas, as well as information on cross-object functions of search and object navigation:

- Material management
- Document management
- Classification system

2.1 Data Objects within the Product Development Process

A *phase model* can display the required data objects and their structures similar to the product development process itself. The generated objects are the results of the

product development process at different stages of the project. The individual structures and data objects reflect the different degrees of maturity of the product development.

Figure 2.1 shows the relationships between the data, its model, and the process. Most of the data is part of a hierarchical structure with relationships between them. The transitions between the individual structures don't mean that a requirement originates from exactly one idea. Rather, you create requirements and targets in a structured manner based on a complete set of ideas using the underlying development process.

Moreover, the individual objects and structures don't stand isolated side by side. Instead, a highly integrated network of relationships and dependencies form during the course of product development. An advantage of doing so is that this visualizes the development steps. A disadvantage is that only the processes based on that data are running.

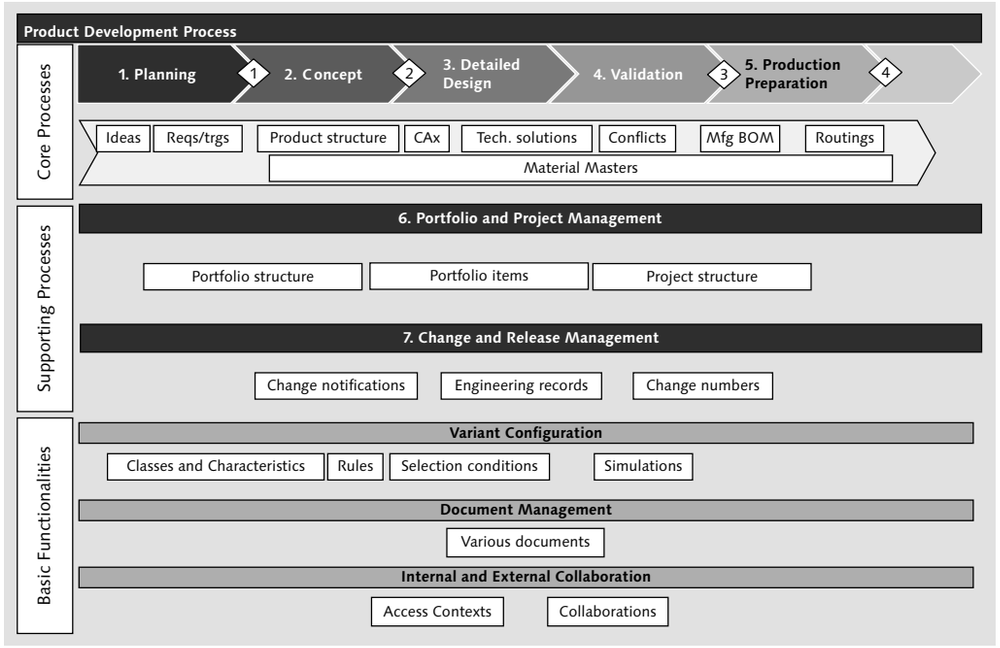


Figure 2.1 Relationship between the Product Development Process and Data in the SAP System

In this book, we describe the individual data objects linked to product development in their respective chapters; each data object supplies parts of the product development process. In addition, we will present other data objects in more detail in this chapter, as follows:

- Objects of the core processes that describe the maturity levels of the developed product, such as bills of materials (BOMs) or requirement structures
- Objects that support the product evolution, such as change measures and classification

The core processes have the following data objects:

- **Ideas**
  Ideas for various questions are collected and organized in a structure throughout the product development process.
- **Requirements and objectives**
  Based on the ideas and requirements from different business areas of your company, you create and structure the requirements and objectives for the new product. Chapter 5 describes this data and its use.
- **Document info record (DIR)**
  From the SAP system perspective, unstructured information such as CAD drawings and models, manuals in Microsoft Word format, assembly instructions, and test reports are stored as DIRs. This ensures that the document structure is compatible with SAP processes. Thus, DIRs are of high importance within the entire process. Section 2.3 describes this in detail.
- **Document structure**
  CAD models form a hierarchical structure, which shows how the parts described in CAD are combined into assemblies This is described in Chapter 7.
- **Material master**
  The material master is the central object for logistical management of the production information. Usually the material master is created directly from development. The material master is also relevant for the entire process, from the product development to other downstream logistic processes. Section 2.2 describes the material master.
- **Engineering product structure**
  The engineering product structure is a hierarchical structure of a product's components according to the modularization of the product. Chapter 7 explains this in detail.

- **Control for the handover of engineering data into manufacturing**
  After creating the engineering BOM (EBOM), it must be converted into a manufacturing BOM (MBOM) or a prototype BOM. Chapter 10 describes this in more detail.
- **MBOM, routing, production resources/tools (PRTs), and plant layout**
  The MBOM is the basis of production and triggers logistical processes (material requirements planning [MRP], stock management, orders, etc.). Moreover, work is scheduled according to the MBOM, as well as the necessary steps for the production with routings and the allocation of resources, PRTs, and work centers. Chapter 10 explains this.
- **Prototype**
  SAP enables you to model physical prototypes in the system to plan and control the assignment of validations to prototypes, considering the prototype's status. Chapter 9 examines this more closely.

The following objects support the product change and release process:

- **Classification system and object classification**
  All mentioned objects must be meaningfully described and searchable within the product development process to be used. Using the classification system described in Section 2.4, you can store additional grouping information about the individual objects, which you can also search. In addition, the classification system is the basis of product variance.
- **Product variance**
  Product variance makes it possible to model, manage, and control product properties that enable the customer to make decisions when purchasing. Chapter 6 describes the topic in detail.
- **Change master and engineering record (ER)**
  In the context of product development, you often modify a developed product for various reasons, for example, to correct errors or for modernization. You manage this change, its documentation, and control, as well as the underlying approval processes, with change management, which we describe in Chapter 12.
- **Validation conflict and change inquiry**
  The product development process often results in information that leads to a change in the product. To justify the change request appropriately, you can document this information in the form of a *quality notification*. Chapter 9 describes this by the conflicts that occur during quality inspections.
- **Portfolio (for projects, products, and components)**
  You use portfolios for various purposes to make strategic decisions regarding the

implementation or use of the managed items (mostly across products and projects). We'll present the benefits of portfolios in Chapter 3.

- **Project and project structure**
  A project represents the development or change of a product (e.g., size of the project), depending on its purpose. The project object controls the scope, scheduling, resource allocation, risks, progress status, etc. You must manage all these things with reference to the components and tasks of a product, as described in Chapter 4.
- **Collaboration with internal and external partners**
  Due to increasing networks and product complexity, the development of a product becomes a collaborative task with an increasing number of process participants, both within the company and without. This collaboration must be managed appropriately to protect the company's data but at the same time to avoid unnecessary administrative tasks. On the one hand, collaboration requires secure authorization management; and, on the other hand, it requires interfaces to export and import product information easily. Chapter 14 shows the corresponding approaches for both.

2.2 Material Management

The material master provides information about the materials used in your company. A material master can represent the following:

- *Products* sold to customers or incorporated into other, more complex products as a component
- Technical components (*assemblies*) that are required to create a product or used as a spare part for maintenance
- *Individual parts,* from which assemblies are composed
- *Raw materials*, which are procured externally and are required for the production of products and assemblies
- *Production resources/tools (PRT)*, which are necessary for carrying out a production step, but aren't part of the product, such as an auxiliary tool or testing device

The material master is an important part of the product lifecycle for numerous processes, as follows:

- **Product development**
  Provides materials to the product structure, using the highest possible proportion of reusable parts (i.e., using as many materials as possible from previous or other products to save costs and minimize project risk).

- **Work scheduling**
  Performs the make-or-buy decision based on the material information. If necessary, it plans the production process of the material, including what activities and which PRT are required to build the material.
- **Material requirements planning (MRP)**
  Plans the requirements and stock of the individual materials according to incoming orders or production planning.
- **Warehouse management**
  Manages the stock for the individual materials in case they are stored using inventories.
- **Procurement**
  Obtains the materials from suppliers required for the company's activities and selects the best suppliers for this purpose.
- **Quality management**
  Checks the quality of the materials in the *goods receipt* (for purchased materials) or *goods issued* (sold materials for delivery to customers).
- **Costing**
  Uses the material information to calculate the financial success of the materials.
- **Financial accounting**
  Uses information from purchased and sold materials to determine realized profits and losses from the company's economic activity.

In the following sections, we will explain how you can use the material master to represent different types of materials in your company. We will also focus more on specific aspects of material management such as how you can manage the link between materials. We will explain how materials are typically numbered, how you manage material master information across your system landscape, and how material management is related to engineering change management.

2.2.1 Material Types

Due to their versatility in the process, the system provides various types of materials that have different functions in the process and to which different information is stored. Following are the most common material types:

- **Configurable material (KMAT)**
  Represents a variant-rich product. The KMAT carries the variance (see also Chapter 6).

- **Finished product (FERT)**
  Represents a finished product that can be sold, but it doesn't necessarily have configuration. Such a material can be a component of a more complex product (e.g., use of a simple transmission as a component in a more complex transmission).
- **Semifinished product (HALB)**
  Represents a material that in the context of the product production process stands in the middle, that is, represents an assembly.
- **Raw material (ROH)**
  Represents a raw material that you can procure externally but not sell.
- **Trading goods (HAWA)**
  Represents a material that the company procures externally and then sells for a profit, without substantially changing it.
- **PRT (FHMI)**
  Represents a material that you need for the production but don't consume. Typical examples are tools such as screwdrivers. Production requires these materials and occasionally renews them. The transition to consider the FHMI material as an investment in the sense of asset accounting is seamless and depends on the value of the material.
- **Spare part (ERSA)**
  Represents a material that is usually not part of the normal production process but is required to repair products. It can be structurally identical to the corresponding product components or be different for subsequent assembly. Frequently, spare parts are manufactured in the normal production process. If the spare part isn't identical to a part of the product, its design may require its own product structure and additional design effort. Regarding the logistics, a separate spare parts management is then required to manage the requirements and inventories of spare parts in exactly the same way as normal parts.

In your system, you can define any other material types and then configure them with specific behavior according to your needs. Section 2.2.8 explains this in detail.

Customer-Specific Material Type

For your printing machine company, you want to separate the design of geometries from the logistic management of the parts, for example, because there may be several parts with the same geometry but different properties (e.g. materials with different colors). Accordingly, you define a new material type for the geometry and assign these geometry materials to the logistically managed materials.

2.2.2 Material Views and Data

To be useful within the complete product lifecycle, the material master must provide information and control parameters for the respective subprocess. For this purpose, the material master displays its data in different views. The views show data screens at different organizational levels of your company, which represent the controlling and organizational data for a particular subprocess. Figure 2.2 illustrates the organizational levels in SAP with, for example, clients, plants, and storage locations in a hierarchy. It also shows the assignment of the material master view to these organizational levels of, for example, production, quality, or warehouse.

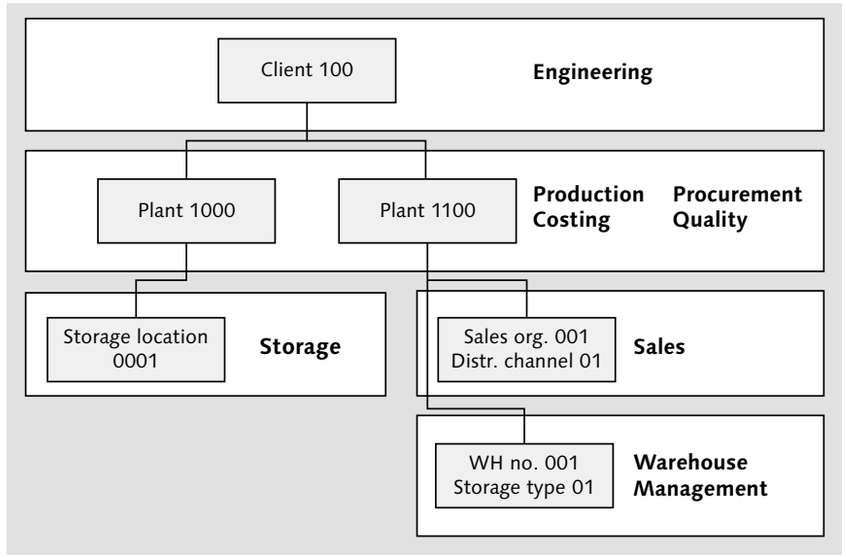


Figure 2.2 Views of the Material Master Organized According to the Organizational Structure

The material type as well as the material master status controls the creation and maintenance of material master views. Frequently used views include the following:

- **Basic Data**
  This view provides the general data of the material master, such as description, unit of measure, weight, and material group.
- **Classification**
  This view catalogs the material with additional customer attributes to search later.

- **Sales**
  This view contains information such as tax data, delivery quantities, and sales texts for the sales process from the request to the billing document maintained for each sales organization and distribution channel.
- **Purchasing**
  This view contains controlling and organizational information such as purchasing group, purchase values, and purchase order texts, which control the process of external procurement. Each plant can maintain this view.
- **Material Requirements Planning (MRP)**
  This view includes the plant-specific data that controls MRP.
- **Work Scheduling**
  This view contains information on the control and organization of internal procurement for production.
- **Warehouse and Storage**
  This view enables you to maintain the information on the material that controls its storage, as long as it's an inventory-managed material.
- **Quality Management**
  This view provides plant-specific information from the material master for quality management, for example, inspection types.
- **Accounting**
  These views are required for inventory valuation in financial accounting and contain information such as the standard price of the material.
- **Costing**
  These views must be completed to calculate a material in product cost planning.

You maintain these views in various phases during the product lifecycle. Material maintenance can be carried out in SAP in three different ways:

- Using the SAP GUI Transaction MM01 (Create), Transaction MM02 (Change), and Transaction MM03 (Display)
- Using SAP Master Data Governance for Materials (SAP MDG-M)
- Using the web user interfaces (UIs) in SAP Product Lifecycle Management 7 (SAP PLM) (create, change, display)

In SAP PLM 7, material screens create the material master using only the engineering data. Therefore, the views that are relevant later in the process aren't present here. Figure 2.3 shows the material master as represented in SAP PLM 7.

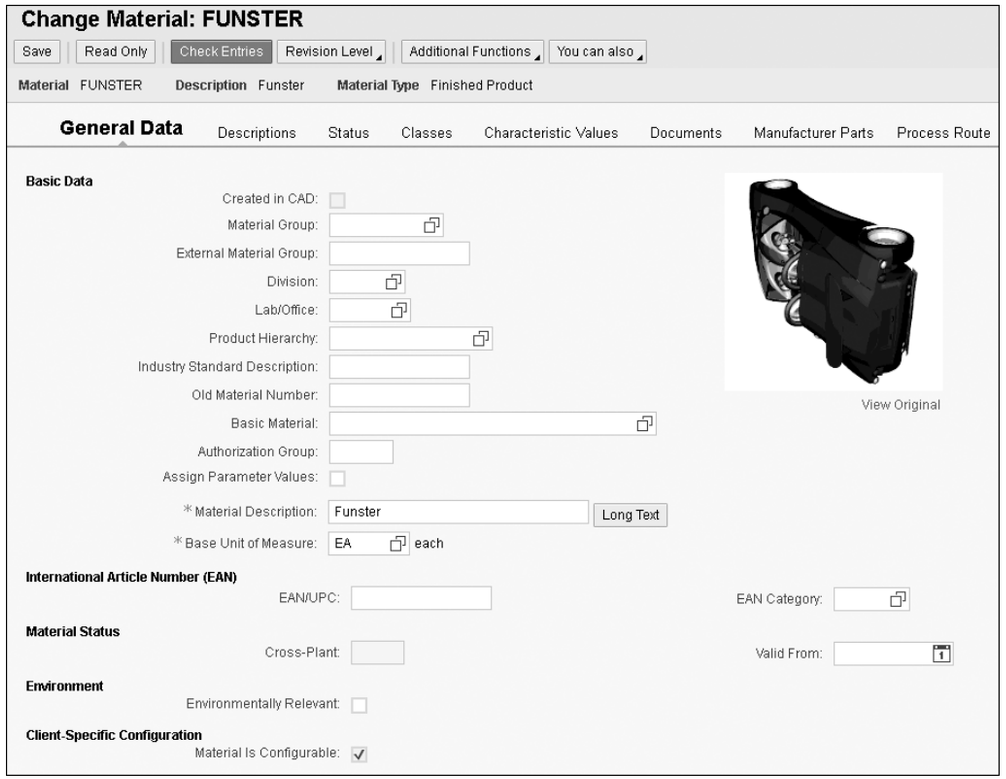


Figure 2.3 Change Material with SAP PLM 7

2.2.3 Usage of Serial Numbers

In principle, a material master represents the common information of a group of similar items. In certain cases, it may be useful to distinguish items individually by implementing serial numbers. The use of serial numbers is relevant in the following scenarios:

- **Inventory management**
  The movement of goods uses serial numbers. In this case, an individual instance of a material master is traceable. You can see the current storage location of the item.
- **Production**
  A serial number is useful in the individualization of the final product in a production order. You use this for valuable or individual items because the serial number allows a better tracking of each individual manufactured product.

- **Sales**
  With a serial number, you can individualize the products to enable individual object tracking, for example, when selling goods to customers. This scenario provides better tracking capabilities to identify which item you delivered to which customer. This is particularly useful if you subsequently take over the maintenance of the customer's product.
- **Plant maintenance**
  The use of serial numbers enables tracking of the installation history of equipment. By activating the **Equipment** view of a serial number, you can also classify, hierarchize, and assign serial numbers to your organizational structure. In addition, you can collect and aggregate performance data, use them in maintenance plans, and so on.

A separate master record represents the serial number of a material master. It has its own status, inventory information (where the item is located), partner roles (who is responsible for the maintenance of the item), and configuration data. Figure 2.4 shows a *serial number master record* for a material master with the activated **Equipment** view.

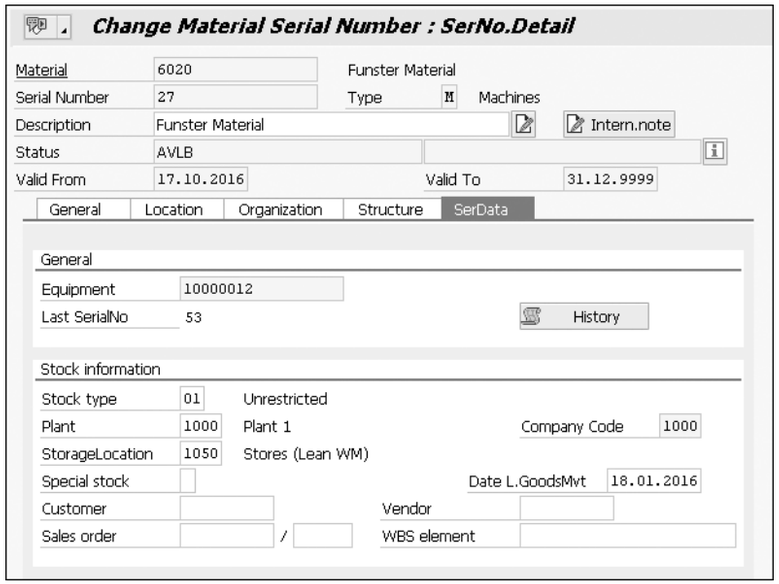


Figure 2.4 Serial Number with the Activated Equipment View for a Material Master

2.2.4 Material Numbering

In your SAP PLM system, you must define a meaningful name or number scheme for the material master objects. SAP provides an 18-character field for the material number, which the customer can use freely. SAP offers the following options:

- You can restrict the namespaces of the material numbers to be material type-specific, so that users can only select certain numbers.
- You can have the material number assigned automatically by the system or by the user who creates the material master.

In either case, the material number is the unique key for the identification of a material master. You can't assign it more than once or change it later. In addition, we recommend that you keep the numbers identically across distributed system landscapes and avoid mappings between different numbering systems to improve clarity and reduce misinterpretation.

In some companies, the material number encodes certain information from the material master, such as the following:

- Type of material, whether it's a product, a tool, a component, or an assembly
- Product in which the material was used for the first time (it's only used as a carry-over part in the subsequent products)
- Assignment of the material to certain development teams or assemblies in order to quickly link it to the right team or agent
- Reference to the material maturity, whether it's a material released for prototyping, test, or production
- Categorization of materials according to the technical solution they represent, for example, a similar naming of all fixings or all steering wheels
- Versioning of the material master

Usually, customers reserve specific digits of the material number for specific information. The permitted values are standardized and stored as part of a numbering scheme. Depending on the amount of required information and its representation, it's possible that the 18 available digits aren't sufficient.

You reap the following advantages when using material numbers to represent information in the material master:

- The numbers provide an immediate understanding of the material master properties.
- The numbers are much easier to remember.

Some of the disadvantages of representing the information in the material numbers include the following:

- Complex numbering schemes often don't provide enough space for future, unpredictable extensions of the product or component range, the teams, and so on. In such cases, companies often soften the numbering scheme afterwards, introducing exceptions to the original logic. This leads to misunderstandings and ambiguities, and significantly reduces the readability and usefulness of the "intelligent numbering."
- You can't change the meaning of a material with regard to the "intelligent" information. If a material got the name of a prototype part, and you could also use it in the series after extensive tests, you still have to create a new material master because the material number contains the information "prototype." This can lead to increased costs, especially in distributed system landscapes and complex links of the master objects in the individual systems.

As a result, we can't give you a general recommendation for or against the display of certain material master information in the material number. A certain amount of information appears to be useful. However, it's an industry- and process-specific case-by-case decision as to which information is and isn't meaningful in these numbers.

In particular, you must consider the legacy data record and its numbering scheme. In this case, we recommend that you only migrate the required material numbers and, in addition, assign completely new material numbers in individual cases to avoid ambiguity.

2.2.5 Materials in the Product Development Process

In the product development process, you usually create material masters relatively early because the material number is the communication medium through which the different parties communicate with each other. A new material master causes enormous costs due to its development and the use of the material in the supply chain. You must procure, store, and provide the material for the production in a suitable way.

Regarding carry-over parts management, you should minimize the number of material masters. Therefore, you attempt to build a new product with as many carry-over parts as possible. These parts have been developed, tested, and used for the predecessor product version or another product. In combination with the variant

configuration, this leads to a complex decision-making process in which you must consider the following factors:

- Economic viability of an additional material master
- Additional costs for the oversizing of certain parts

If the use of a carry-over part isn't possible or not strategically desired, you must develop a *new part*. You can use the combination of both, the *synergy part*, to reduce development costs considering the same logistical costs. In terms of costs incurred, the difference to the new part is significantly lower than to the carry-over part.

The *variance* of a product has an especially high influence on the number of required material masters. A typical example of this is the sizing of individual parts.

Variant-Driven Material Masters

Your company is in the commercial vehicle industry and produces trucks. You design trucks for different permitted total weights, for example, between 7 and 40 tons (t). The frame must be able to carry that weight.

Correspondingly, you define three frame types, one for 10 t, one for 20 t, and one for 40 t. These frames have different properties and prices. Therefore, you need three different material masters per altered frame part. As a result, your product variance significantly increases the number of required material masters.

Further examples of variant-driven material masters are materials with color variance, which are very common in discrete production. The designer develops the shape of a part but already knows that this part will have different colors or substances depending on the specific product configuration. In this case, you create a separate material master per combination of color and part because these parts are logistically different (see Chapter 6, Section 6.2.5).

Material Masters for the Representation of Color Variance

You install driver's seats in your trucks. They always have the same shape, but depending on the design of the interior, your customers will get a black leather cover or a gray suede cover.

These seats are identical from an engineering point of view, but logistically they are different units. If you have a black seat in the warehouse but need a gray seat, you must be able to recognize this and order the right seat. This is why you need two different material masters, one for the black seat and another for the gray seat.

2.2.6 Consolidation of Material Information

For many discrete manufacturing companies, a complex system landscape is in place consisting of many different systems that must work with the material master information. These include, for example, several product development systems, plant-specific manufacturing systems, business intelligence (BI) systems for reporting management, and so on.

If each participant maintains the data separately in his/her own system, this leads to low data quality, misunderstandings, and thus errors in the product. In addition, some companies create materials multiple times and structure actually identical product structures in different ways, which leads to high additional costs over the product lifecycle.

To avoid these problems, you maintain the material number and material master data centrally in the SAP PLM system. If you completed this maintenance successfully, you make the new material master as well as the changes available in all connected systems to use them consistently. For this purpose, a centralization of the material master creation is required as well as an automatic interface for distribution from the master data system to the other dependent systems.

SAP Master Data Governance (SAP MDG) is suitable for the following tasks:

- Harmonization of the material master creation, with the possibility of using most material views
- Effective search and merge of material duplicates
- Extraction of material master information from the source system and distribution into the target systems
- Creation and changes using a complex workflow engine controlled by Business Rules Framework plus (BRFplus)

You use a staging area in which you maintain and validate changes in isolation from the SAP ERP system. The transfer to the actual data (and transfer to third-party systems) takes place only with the release of the changes.

With that, you achieve the following goals:

- Material numbers are assigned only once (no system-specific multiple assignments with different meanings).
- Inconsistencies in the material master information between the individual systems are avoided.

- A controlled process is established, with which you create materials. This ensures that you always create and change material masters with reference to a change measure and minimize the risk of errors.
- Multiple creations of the same materials as different material masters are avoided and even corrected subsequently, which is the basic prerequisite for a working carry-over parts management process.
- A central point is defined where the correct information is stored. This is crucial for removing inconsistencies and for creating high-quality reports.

Because the change management process underlies the development of the material master information, the consolidation of the information must always take place in the context of the change measure and its status. The transfer and distribution of changed data takes place only after material maintenance and the release of the change. Chapter 11 describes the change process with SAP MDG.

SAP MDG is suitable not only for the consolidation of material masters but also for other master data objects such as suppliers, customers, business partners, and finances. Figure 2.5 shows the material master data in a change request in SAP MDG-M.

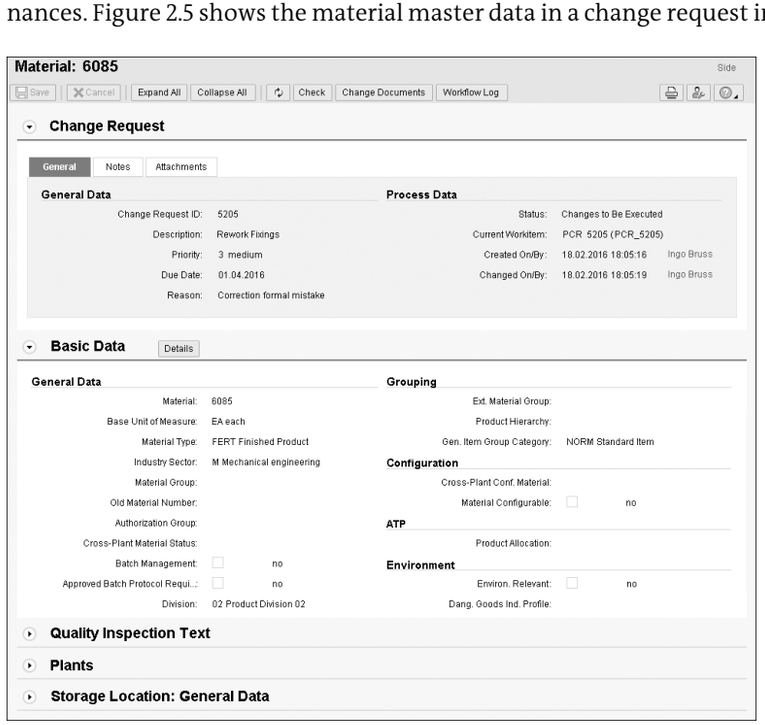


Figure 2.5 Material Master Data in a Change Request with SAP MDG-M

2.2.7 Material Master Changes

When using a material as carry-over part with corrective and reworking requirements, a material might need to be changed in the course of its lifecycle. Therefore, you must always distinguish whether the changed material is interchangeable or not. We explain the details of interchangeability in Chapter 12, Section 12.1.3. You decide whether the revised material is a new material master or whether you keep and rework the original material.

The change of a material master that is part of a product structure can lead to changes on other levels of the structure. For example, the change of an individual part results in the change of the assembly or even the whole product that uses the individual part.

To document changes on the material master, SAP offers three approaches:

- Material revisioning
- Change index
- Versions of DIRs for the representation of material versions

These three approaches are described in Chapter 12, Section 12.1.5. There, we explain why you can't distinguish revisions and versions logistically. We also describe the implications for logistics scheduling, as well as the conditions (interchangeability with form fit function, FFF) for the creation of a new material master or simple versions.

Figure 2.6 shows a change scenario with versioned documents in SAP PLM 7. The individual versions represent the compatible changes of the material master. You can also represent baselines of the material in this way.

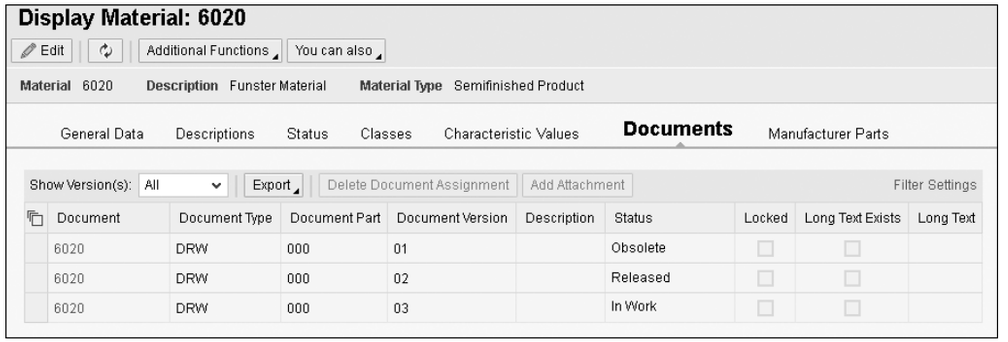


Figure 2.6 Material Versioning Using DIRs

2.2.8 Configuration and Authorizations

You can find the configuration settings for the material master in the Implementation Guide (IMG) under **Logistics – General • Material Master** (see Figure 2.7).

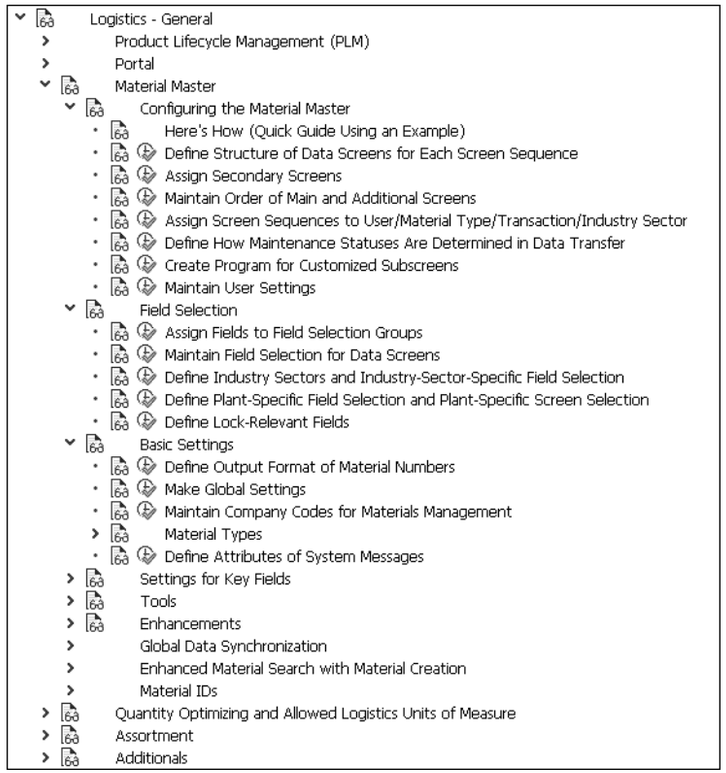


Figure 2.7 Material Master Configuration

The most important setting is the definition of the **Material Types**. The material type controls the following:

- Whether the material has a specific purpose, for example, configurable material, manufacturer part, or process material
- For which areas the material will be used (see Section 2.2.2)
- The sequence of screens the user sees for a certain material type, which also defines how material information can be viewed and maintained

- Which classification class is to be assigned by default
- Whether the material is numbered manually or automatically, as well as the numbering intervals
- Which procurement type the material has, that is, whether it's procured externally, produced in house, or both
- Whether a separate SAP Graphical User Interface (SAP GUI) transaction is needed for the material type creation
- The inventory management obligation for the material in collaboration with the plant, that is, whether changes in the material master record and value changes are updated in the SAP ERP Financial Accounting (FI) inventory accounts
- Which accounts are used for posting when the stock of the material changes

Field control is also very important, that is, the decision regarding which fields are visible, ready for input, or even mandatory. You find these settings under **Field Selection**. Here, you assign these fields to the material branch or certain plants so that you can provide plant-specific process flows. In addition, you can define the value ranges of different central fields of the material master in the settings for the central fields, for example, the material group, divisions, laboratories, basic materials, and so on.

You can find the configuration settings for master data governance for material masters in the IMG under the following two headings via the menu path **Cross-Application Components • Processes and Tools for Enterprise Applications • Master Data Governance**:

- **General Settings**
  Here, you define the relevant Remote Function Call (RFC) connections to the SAP MDG client systems to receive the material master data from the central hub. You maintain the data model for the transfer, configure the UI for maintenance, and model the governance process with regard to scope, actions, and workflow.
- **Master Data Governance for Material**
  Here, you define the mapping of the SAP MDG hub fields against the SAP ERP fields for data transfer, as well as intermediate document (iDoc) fields for transfer using Application Link Enabling (ALE) to third-party systems.

There are also authorization objects that control the authorization to maintain material masters. Table 2.1 lists a selection of the most important authorization objects.

Authorization Object	Description
M_MATE_MAR, M_MATE_MTA	Allows you to specify who can use which material types to create, change, and display material masters. The additional authorization object M_MATE_MTA allows you to change authorizations depending on the material type.
M_MATE_MAT, M_MATE_NEU	This authorization checks directly who can maintain it based on the individual material master. For this purpose, the authorization object M_MATE_NEU controls whether the user can create materials.
M_MATE_WRK, M_MATE_VKO, M_MATE_LGN, M_MATE_BUK	Several authorization objects allow the maintenance of material views based on the respective context. M_MATE_WRK allows the maintenance of the plant views depending on the plant. M_MATE_VKO depends on the sales organization. M_MATE_LGN depends on the warehouse number, and M_MATE_BUK depends on the company code.
M_MATE_STA	Enables the maintenance of material masters depending on the maintenance status, that is, which area of the organization has created it.

Table 2.1 Authorizations for Materials Management

2.3 Document Management

The management of electronic documents (files) using databases is an important basic functionality of PDM. The application that is capable of processing the file reveals its meaning. For example, a CAD system is able to open CAD files, display the contents, and modify them in a meaningful way. Thus, document management is broadly equivalent to the operating system, which is capable of managing files and providing the right application when needed.

Numerous standards deal with the documentation of products and the administration of this documentation. They describe the application of document management in the context of product development. Some examples include the following:

- **DIN 199-1: Technical Product Documentation**
  Defines the terminology in the technical product documentation.
- **DIN 6789: Systematic Arrangement of Documents**
  Defines requirements for protection against falsification and quality criteria for the release of digital product data.

- **DIN ISO 11442-1 to -4: Technical Product Documentation**
  Specifies basic rules for computer-based handling of technical documents.
- **DIN ISO 15226: Technical Product Documentation – Life Cycle Model and Allocation of Documents**
  Introduces product documentation in the context of the product lifecycle and describes how documentation affects the performance of activities in the product development process.
- **DIN EN 82045-1/2: Document Management**
  Describes principles and methods (Part 1) as well as metadata and information reference models (Part 2) of document management.
- **Directive 1999/93/EG: Electronic Signatures Directive**
  Describes the requirements for digital signatures in the context of technical product documentation.

In the product development process, you require documents in various situations. Following are some typical examples:

- Design and other development results (CAD models, software binaries, drawings, etc.) and the corresponding derived conversions into neutral formats (e.g., as PDF, JT, RH, or VDS4 files)
- Test protocols from product validation (generated by the validation tools and stored for documentation purposes)
- Work results from product development that aren't represented in the system itself (e.g., requirements lists, tables from variant configuration development, prototype planning)
- Approval documents (e.g., signed release history of the product development or signed approval to execute a change measure)
- Legislative texts, which the designer must consider for the authorization of the product
- Reference manuals, work instructions, and general content that serve the accompanying documentation of product development
- Baseline of a structure (e.g., a presentation that represents a development project and has been created automatically with the system data)

In principle, almost all the results, documentation, and work steps of a process can be stored in document form. The management of a process step based on documents represents an unstructured form of mapping that process. Although the system has all the product data, it can't interpret or validate that data.

A typical pattern in a PDM implementation is to decide how you will execute certain process steps in various areas. This execution process is either based on specific, partly self-implemented objects structured in the system or on the essential information development taking place outside the system, for example, in the form of spreadsheets, text documents, or CAD files, with the results stored as documents for documentation after completion in the PDM system.

The first alternative has the advantage that the systematic control of the work results by the system guarantees higher data quality and thus fewer errors. The second alternative allows more flexible handling and easier modification of the information as well as a clear segregation of the process within the system landscape. This is particularly useful in early planning processes, creative development processes, and for computer-aided technologies (CAx) applications because too much structuring limits the process capabilities, which means the representation within the SAP PLM system isn't effective.

In the following sections we will go more into detail about SAP Document Management System. We will explain the main features it provides to users. We show how document originals can be stored in distributed scenarios, how you can structure documents, and some typical use cases.

2.3.1 Features of the SAP Document Management System

Features that go beyond plain file storage characterize advanced document management systems, such as the SAP Document Management System (SAP DMS). This section will look at the main features of SAP DMS.

Document Info Record

Storing documents in a system often requires a mechanism to organize content that goes beyond simple file storage. This mechanism allows the required processes to be executed with these bundled file blocks. The DIR can manage several original documents (files), support the change and release process, and enrich the documents with structured customer information in the classification (see Section 2.4).

Document Info Record for Information Organization

You want to manage the CAD models that your development team creates for your new medical ultrasound device in the SAP system. However, your engineers aren't just developing CAD models. Rather, they also create additional information, such as two-dimensional drawings, and so on. In addition to the developed components, this additional information must be stored to locate later in the system quickly and not to develop parts twice accidentally.

To manage this information, you can use a DIR, which is the carrier for the developed files and the additional information.

The *document key* uniquely identifies the DIR. This key consists of the document type, document number, document part, and document version. The DIR is also the central instance for storing structured information about the document in the form of attributes. The cataloging based on documents also takes place by using the DIR classification.

Figure 2.8 shows the basic data of the DIR together with the list of contained files.

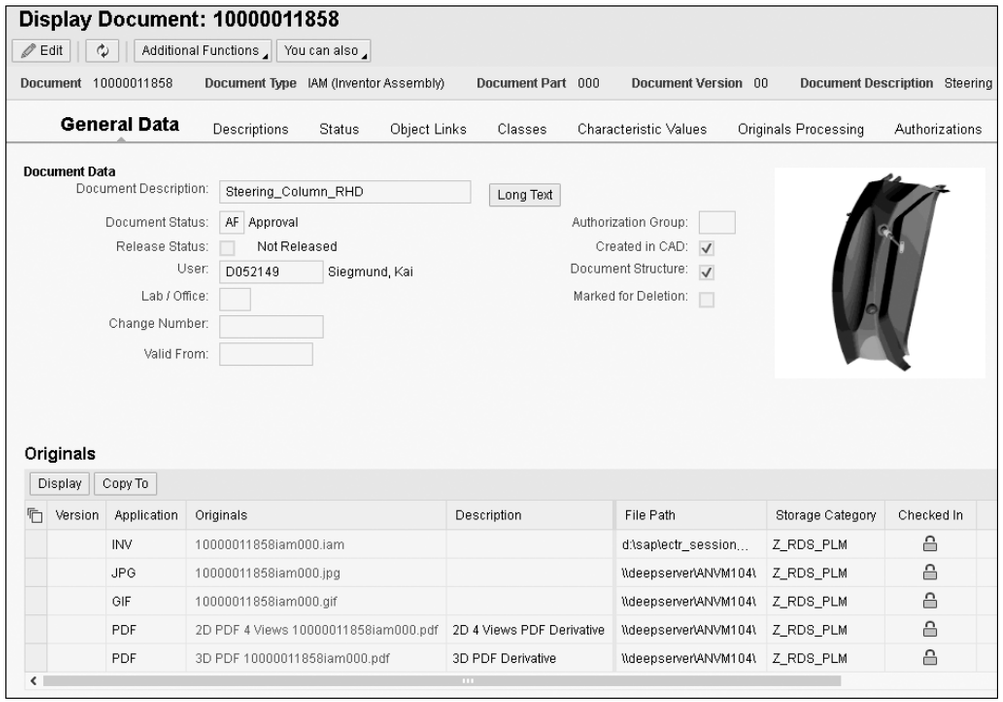


Figure 2.8 DIR in SAP PLM

Document Type

Documents are required in different contexts of the product development process and other processes. The SAP DMS document type defines the usage context of a document, which controls the process of the document, influences the information and files, etc. Section 2.3.4 explains the possibilities in more detail.

Context and Structure

Documents have their meaning in the product development process through the object and structure context in which they are used. For example, you can only meaningfully use the CAD model of a steering wheel in the context of the product design by assigning it to a material master which represents this component logistically as well as in product structures. For this reason, SAP DMS offers the possibility to relate the DIR to other data objects in various ways. See Section 2.3.3 for more information.

Process Reference

In the context of product development, it's necessary to record the completion of document-related content. For this purpose, SAP DMS provides the document status, which documents the current state of a DIR. To maintain a structured status sequence, you can configure the status network that keeps the sequence of the process status, as shown in Figure 2.9.

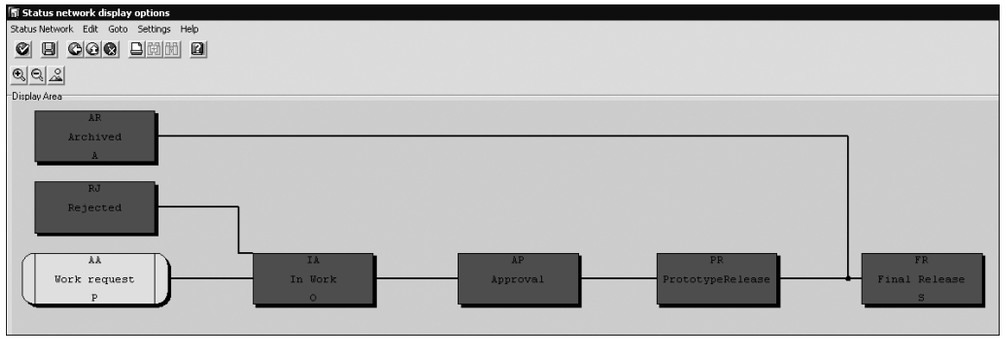


Figure 2.9 Status Network in SAP DMS

With the status network, it's possible to add a structured procedure to the assignment of the status that embeds the document in the process context. In addition, by

using a digital signature, you ensure that additional information about the process participants and their actions on status transitions are revision-proof.

You can also integrate DIRs into workflow management. In SAP PLM 7, you can start the process route of a DIR as an ad hoc workflow through which additional process participants are involved, receive information, and make the required decisions.

Versioning and Change Reference

Within the scope of work on a product and its documentation, there are different states of the involved documents. On the one hand, traceability is important because the change measure for a new development or a correction must be documented (see Chapter 12). On the other hand, it's necessary to document several states of a document in the system. For this purpose, SAP DMS enables versions in the DIR. The versions can be assigned automatically and represent the different states that the document had during the course of each development cycle. Because you can mark a DIR with a revision, it's possible to flag specific maturity levels of the document development.

Especially in the context of product development, a versioned DIR is suitable not only to keep the development documentation in the system but also to represent the development status or the drawing states of a material master.

New Document Version

In your printing machine company, you've designed and developed a new rotary offset press machine. Using the validation results, you determine that minor changes to a roller suspension are necessary. You search for the DIR that documents the CAD model of the roller suspension and create a new document version. In the DIR screen, you save the changed CAD model.

In the context of the integration with authoring systems, the system usually carries out this procedure automatically after a user decision, as described in Chapter 8.

In addition, SAP change documents can be used to document and track changes to the DIR.

Visualization

Original documents in the DIR often contain text, images, graphical representations, or results of the development process which the user must display or edit. For this

purpose, SAP PLM 7 enables SAP 3D Visual Enterprise to visualize and edit the content of the original document in the context of the DIR, as shown in Figure 2.10 (see also Chapter 13).

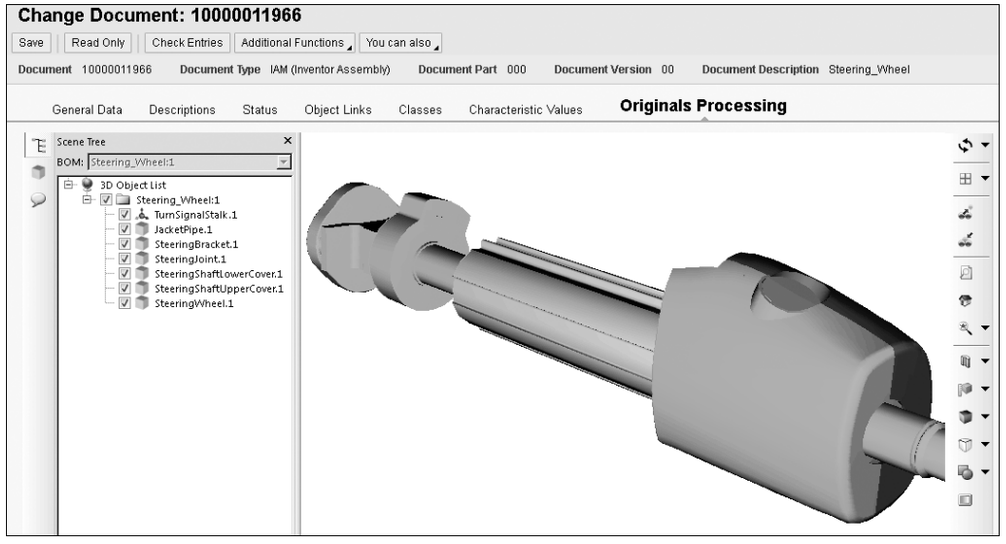


Figure 2.10 Visualization of an Assembly in SAP PLM

Visual Analytics

The Business Context Viewer (BCV), which you can use to retrieve customer-specific information on the DIR, also improves the user's understanding of the documents' context.

Digital Signature

The digital signature of a document allows you to document the approval of further processing. Unlike the normal status change, the digital signature provides the assurance that only authorized employees can influence the process. In this way, you meet the requirements of Good Manufacturing Practices (GMP) and implement appropriate directives such as 1999/93/EC on general conditions for electronic signatures.

You choose the DIR status by assigning a signature strategy and the processing situations in which the user must consider the digital signature. By setting the document status, you trigger the approval process.

Possible signature strategies include the following:

- **Double verification principle**
  An authorized person signs and sets the required status.
- **Multiple verification principle**
  Several authorized persons sign.

The system documents the information on the signature, such as the signing user, the working step, the comment, and the time stamp. You can see this information in the DIR. The status, which has been set through the signature, is also visible there. You can also search a DIR using the digital signature.

SAP enables you to use digital signatures in other business processes to document status transitions against fraud, for example:

- In change management (status change for change requests and object management records [OMRs] may require signatures)
- In SAP ERP Quality Management (QM)
- In the production planning of the process industry

Internal Collaboration

Due to the complexity of the results, usually large product development teams execute that process. Therefore, document management must support the processing of documents in a collaborative manner. SAP DMS enables the user to document which files are being processed by the check-in and check-out mechanism. This ensures that users don't make concurrent file changes, and data quality is increased.

In addition, *document redlining* supports user collaboration in the SAP 3D Visual Enterprise Viewer. This allows the user to submit annotations to the content of individual files. For example, the user can comment directly on the models of designed components and then hand them over to the product developer for further processing. Furthermore, SAP DMS allows the assignment of a DIR to internal or external teams with the attribute **Laboratory/Design Office**.

Collaboration with External Partners

Due to increasing complexity, the collaboration of product development with external partners has become more important as well. As described in Chapter 14, various SAP solutions such as *SAP Jam* or *SAP Documents Center* are suitable for distributing documents according to the application scenario.

Efficient Data Storage

Especially in design processes, the users create immense data sets because CAD models have file sizes of several hundred megabytes. These files must be available to numerous users in the course of collaborative development processes, which is a challenge for the storage and distribution infrastructure of the documents. We explain this in Section 2.3.2.

Document Search

An essential use case of document management is the search of existing documents. We describe the search capabilities in Section 2.5.

2.3.2 Document Originals

The primary goal of document management is the storage of files, called *document originals* in SAP DMS. These originals are bundled into DIRs, which represent them in the process context.

When storing document originals in SAP DMS, you assign a workstation application to each document original, which controls how you use the document original. For example, it decides which application the system calls to display or change the original, and it controls which files are even eligible. For example, you can configure a workstation application for Microsoft Word to accept only files with the extensions *.doc* and *.docx*.

SAP DMS stores the received document source in a content repository. You normally use the Knowledge Provider (KPro) from SAP for this purpose. It controls the storage and distribution of the data in the storage system. The following media are frequently used for storage:

- **SAP database**
  The files are stored as entries in a database table. This has the disadvantage that the database is loaded with large amounts of information. In addition, you can only store and display the file contents via an SAP application server, also consuming this resource. For this reason, this approach is usually only used in development environments and isn't suitable for productive use.
- **Separate file server**
  The files are stored on a separate file server, which the SAP system controls. This has the advantage that both the database and application server only have to manage the references to the contents in the file server. Storage and query of the contents take place directly between the file server and client.
- **External file server**
  The files already exist on an external third-party content management system. To avoid redundancy, you don't want to duplicate them on the SAP file server. The SAP system only holds references to the files in the external content management system and doesn't store them in its own repository. This approach often is used to connect external authoring systems or integrations, which have their own data storage.

Due to the high performance requirements of a document management system, it's possible to use a distributed server landscape instead of just one central content server. In this case, you use several distributed content servers instead of a single file server to speed up the storage of document originals. Depending on the locations of the users, you can define a suitable categorization of the document to be stored, as well as a content server that the user can reach conveniently.

In addition to several content servers, you can also set up cache servers. Cache servers accelerate read access to document originals by fetching originals from the content server and providing them as file copies. The system copies only the required documents, which makes global access to content much faster. Figure 2.11 shows a possible landscape scenario with multiple content and cache servers.

The storage of document originals is also the basis for product data visualization, which we explain in Chapter 13. The SAP 3D Visual Enterprise Viewer accesses the required originals, reads them out, sends them to the client system where necessary, and displays them there. Other tools, such as the data acquisition for the product validation, also access the document contents and provide them to their corresponding applications.

The automated conversion of the existing and imported files into other file formats is an essential functionality of SAP DMS. A typical application scenario is the automatic generation of neutral format files such as TIFF or PDF. In addition, for digital mockup (DMU) visualization, the converter creates 3D formats such as RH or VDS4 files. Due to the large number of possible input formats, there can be no generic conversion process for all scenarios. SAP DMS provides a generic interface to which third-party conversion servers are connected. This retrieves the original file from SAP DMS and automatically stores the resulting file in the DIR after successful conversion. In

particular, the SAP 3D Visual Enterprise Generator described in Chapter 13 can perform the conversion.

For collaborative work on document originals, a tool for data access must meet high requirements in terms of usability. SAP offers several such tools that are suitable for different applications. We explain these tools for collaboration, such as cFolders, in Chapter 14. You can also use other tools, such as web documents or SAP Easy Document Management, for the SAP DMS handling.

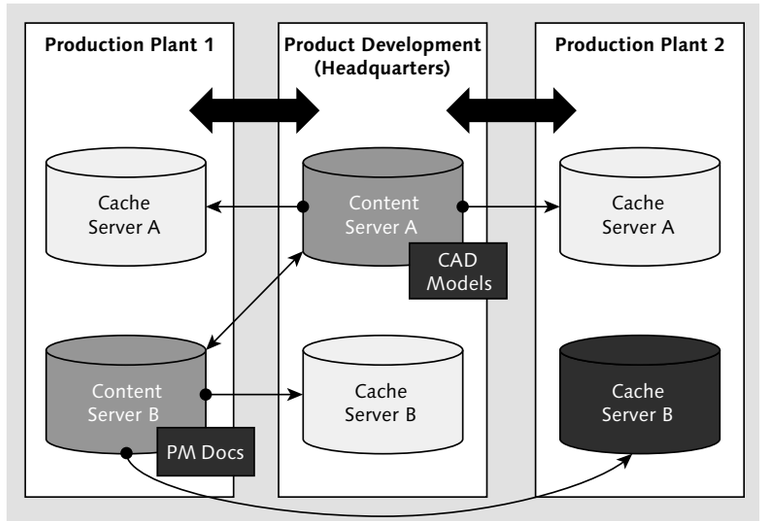


Figure 2.11 Content Management Server Landscape with Multiple Content and Cache Servers

2.3.3 Document Structuring

To make meaningful use of documents in the product development process, you must manage the context in which they are applied. For this purpose, SAP DMS allows DIRs to be linked with numerous product data objects. As a result, you can display and access the linked objects to the DIR, as shown in Figure 2.12. There are also representations for the individual product data objects. There, you can see the individual DIRs that you linked to the respective object.

You use these object links in customer implementations to execute various operations.

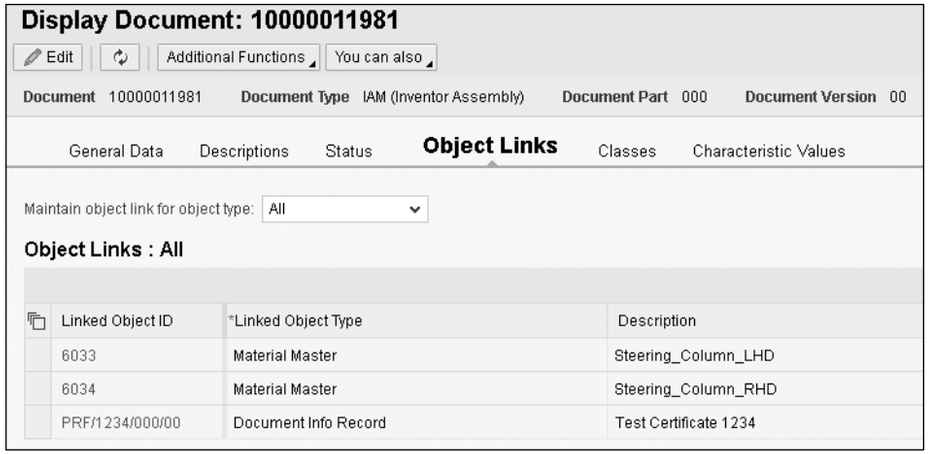


Figure 2.12 Object Links between a DIR and Several Other Objects (Material Master, Document)

Automatic Assignment to Change Management

In the course of your change process, you've defined that the assignment of a CAD DIR to an ER should lead to all material masters of that DIR linking automatically to the same ER for documentation purposes. You can implement this behavior by making use of the existing object links between the document and the material.

It's also possible to create BOMs from DIRs. On the one hand, you can add DIRs as document positions into classic MBOMs, for example, to add documentation, manuals, function parameters, and so on, which the system doesn't represent as parts (i.e., material masters). On the other hand, the DIR can also be the header of a separate document structure. You use this, for example, in the representation of hierarchical CAD models, which you transfer from CAD using the integration of authoring systems. Chapter 7 explains this structure in more detail. Because such a structure represents a product part, you can visualize it in Product Structure Management (PSM) below the PSM structure, as shown in Figure 2.13.

In addition, you can use the document structure to build up hierarchies in which you insert the actual documents only at the lowest level. The goal of such a structure is the organization of the document information according to different requirements, similar to the organizing files by using file folders.

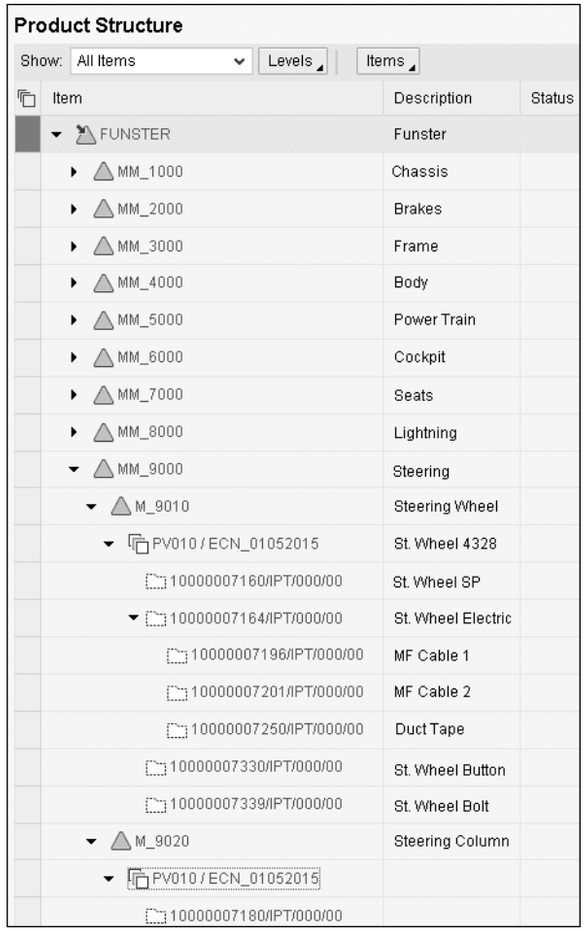


Figure 2.13 PSM with Linked Document Structure

You can display and maintain these structures in the document browser, which provides a hierarchical overview of the individual DIRs and makes it possible to display and maintain their details, such as attributes or document originals. Figure 2.14 shows the document browser.

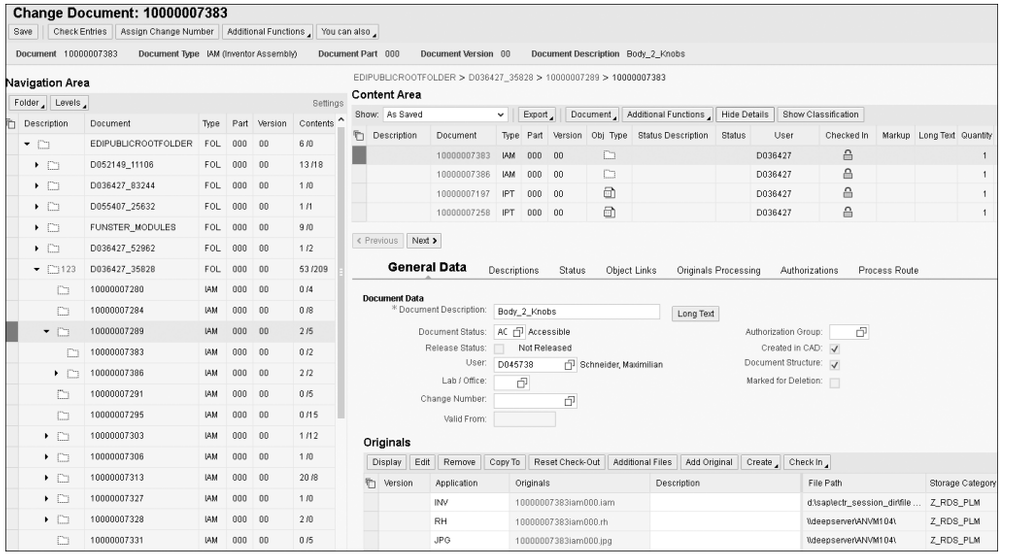


Figure 2.14 Document Browser in SAP PLM

2.3.4 Configuration Authorization

SAP DMS configuration settings can be found in the IMG under **Cross-Application Components • Document Management** (see Figure 2.15).

Following are the most important SAP DMS configuration settings:

- **Define Document Types**
  This enables you to maintain the document types that control the behavior of the document, including the following:
  - Status and status net of the document
  - Field control per document type, that is, which fields are available, ready for input, and so on
  - Allowed number range intervals for the document type with internal or external number assignment in order to assign document numbers automatically
  - Automatic document versioning and how versions are defined (numerical, alphabetical, or alphanumerical)
  - Automatic assignment of a class for document classification
  - Allowed object types to be linked to the DIR

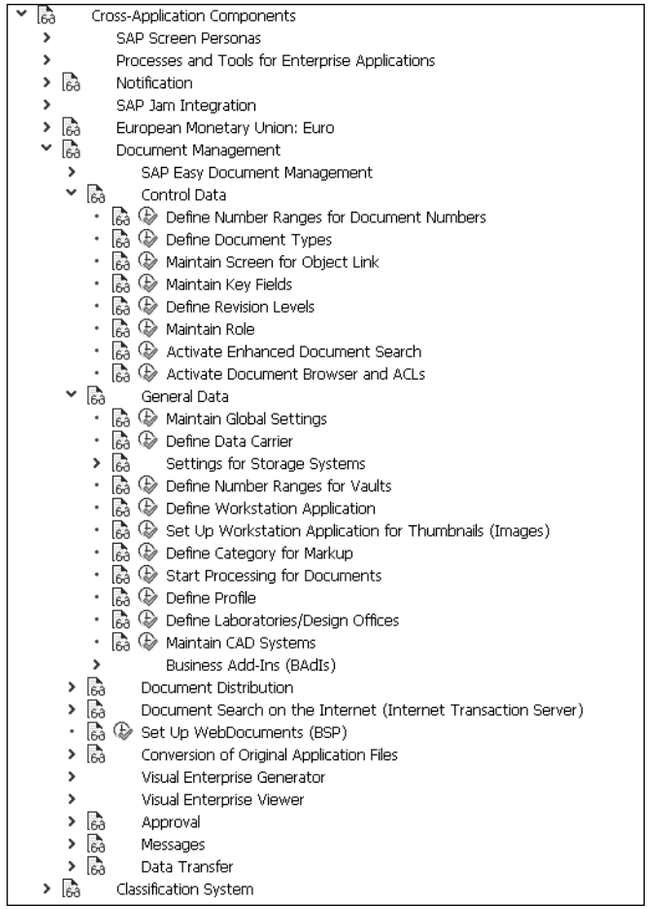


Figure 2.15 SAP DMS Configuration

- **Maintain Screen for Object Links**
  This allows you to provide additional objects for object links with DIRs.
- **Activate Document Browser and ACLs**
  This allows you to use the document browser as well as the authorization control for documents, which we describe in more detail in Chapter 14.
- **Settings for Storage Systems**
  This opens the settings of the KPro where you can define the connection to the content server and the storage category for use in SAP DMS.

- **Define Workstation Application**
  This allows you to maintain the workstation application assigned to the document original. The workstation application controls the following:
  - Allowed file extensions for the document original
  - Document icon of the document original
  - Frontend applications used for creation, display, and change
- **Conversion of Original Application Files**
  This defines the settings required for document conversion. Here you define the access to the conversion tool via the RFC destination, the parameters for the conversion, the workstation applications for source and target formats, and so on.
- **Visual Enterprise Generator/Visual Enterprise Viewer**
  These are explained in detail in Chapter 13.
- **Approval**
  This sets up the digital signature. Here, for example, you define the signature strategy, that is, which roles the signers must have and the order in which they sign.

Further settings that enable the use of documents in SAP PLM can be found in the IMG under **Logistics - General • Product Lifecycle Management (PLM) • PLM Web User Interface • Objects in PLM Web UI • Document in PLM Web UI**. There you can specify which document types you want as folders in the document browser. Furthermore, SAP provides some Business Add-Ins (BAdIs), along with some other configuration options, which you can use to influence the behavior of the SAP PLM 7 web UI.

In addition to the preceding configuration options, you must also set the configuration settings for SAP PLM 7 web UI in the IMG under **SAP NetWeaver • UI Technologies • WebDynpro ABAP**. Here, you set up the local folders from which users can upload files, which file extensions you allow, and which files are to be displayed in the web UI with the help of specific applications.

There are also some authorization objects in document management. The most important ones are listed in Table 2.2.

Authorization Objects	Description
C_DRAW_TCD, C_DRAW_TCS	Enables general access (create, change, display) to DIRs per document type. The corresponding status-dependent authorization is C_DRAW_TCS.

Table 2.2 Authorizations for the Document Management System

Authorization Objects	Description
C_DRAW_BGR	Allows you to restrict general access with authorization groups. The authorization group is a descriptive field on the DIR. If it's set appropriately, you can define, for example, secret documents or assign certain documents to specific teams.
C_DRAW_STA	Controls which status the user may set for the document type.
C_DRAW_DOK	Allows the user to access the document originals, depending on the document type. If a more precise control is required, for example, one that allows the user to open only originals with a particular file name, then you can implement it with a customer-specific extension in a BAdI.
C_DRAW_OBJ	Controls what object links the user can create, change, display, or delete for each document type, object type, and document status.
C_SIGN_BGR	Authorizes the signing of a document.

Table 2.2 Authorizations for the Document Management System (Cont.)

2.4 Classification System

You use the classification system to define object characteristics, to group them together, and to assign them to the corresponding product data objects so that you can classify the objects by these properties. Classification can be used with almost all areas of the SAP application. If you classify the objects in this way, you can search for them according to the evaluation of the object.

Classification Search

As a manufacturer of medical ultrasound devices, you want to maintain the characteristics for the various monitors that you manufacture such as power consumption and imaging quality.

After you've evaluated these characteristics for your monitors, a product developer who designed a new ultrasound device can easily search all available monitors for the required characteristics, finding all the monitors that are appropriate for his/her needs.

Bundled product characteristics can also be used to describe the variance of products or components. Chapter 6 describes this in detail. In the following sections, we explain how the classification system is set up based on class, characteristic, and characteristic value master data. Then, we show how you use the classification systems in order to categorize and describe the master objects.

2.4.1 Characteristic and Characteristic Values

You use characteristics in Variant Configuration and classification to display the variable properties of the product. A class bundles these properties and assigns them to the configuration or the classification.

You carry out the master data maintenance for a characteristic using Transaction CT04. Figure 2.16 shows the maintenance of the characteristic values for a characteristic.

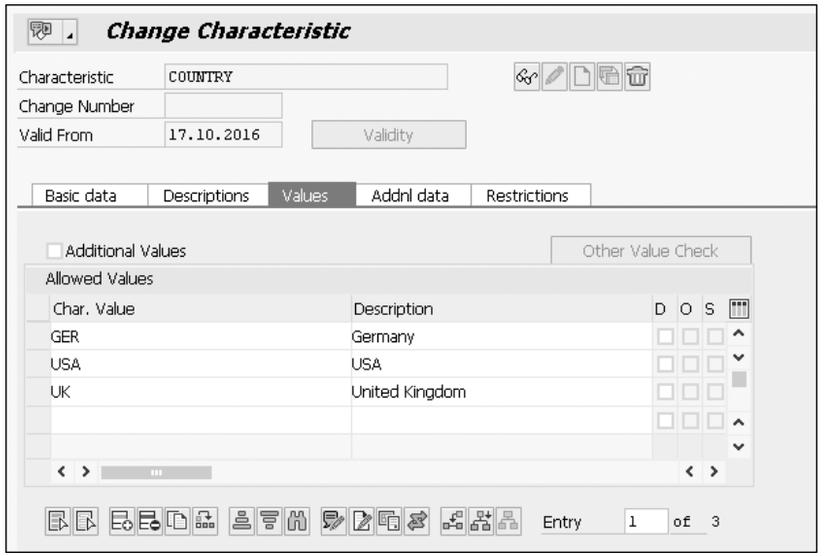


Figure 2.16 Maintaining Characteristics and Characteristic Values with Transaction CT04

In this transaction, different types of information can be stored for the characteristic:

- Description text of the characteristic is maintained in the different languages on the **Descriptions** tab.

- Status of the characteristic appears on the **Basic data** tab, for example, to enable a release process for the characteristic.
- Data type and length, if the characteristic should be character-like and allow the entry of a text or a number, a date, and so on are available on the **Basic data** tab as well.
- The characteristic values that you allow for the characteristic, including a description text for each value, are listed on the **Values** tab. If the characteristic values aren't specified, the characteristic can be evaluated freely for the given data type. A combination, that is, a predetermined value set and free selection of a further value, is also possible. In addition, you can use a database table as a check table or a function module that checks the values or provides them as value help.
- Will the characteristic be single-valued or multivalued? Single-valued characteristics only allow the selection of a single characteristic value in the configuration scenario, whereas multivalued characteristics can have several values simultaneously.

Single or Multivalued Characteristics

A feature called Power with the values 100 HP, 150 HP, and 200 HP is single-valued (a selection of several values simultaneously isn't meaningful).

A feature called Optional Accessories with the values Electronic Window Lifters, Rain Sensor, and Bending Light could be multivalued (a combination of several optional accessories is useful).

2.4.2 Classes

To assign characteristics to the business object and to classify it, you combine the characteristics in one class. Then, you need to assign the class to the object. You can maintain classes with the following SAP transactions:

- Transaction CL01 (Create Class)
- Transaction CL02 (Classes)
- Transaction CL03 (Display Class)

Figure 2.17 shows the assignment of the characteristics to a class in Transaction CL02.

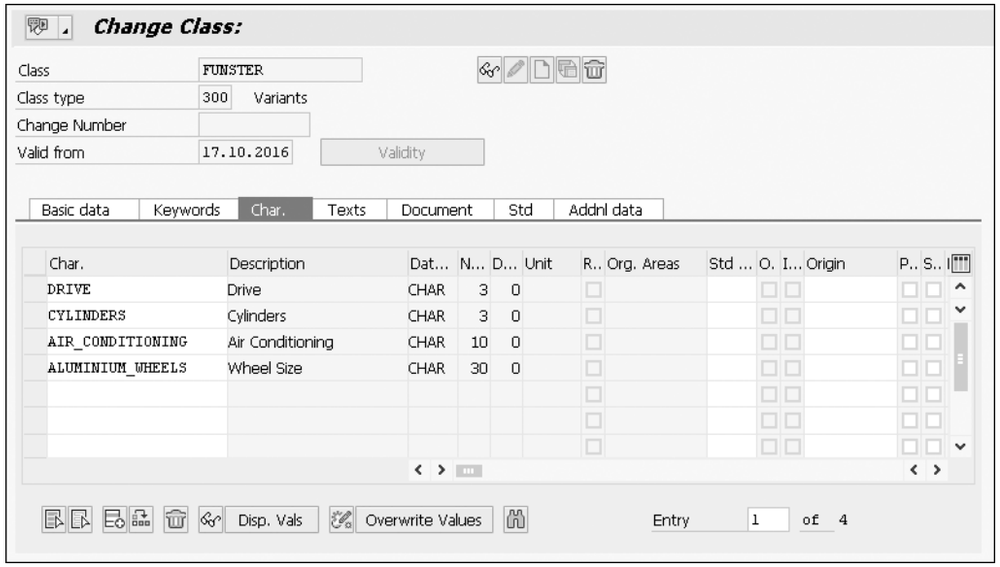


Figure 2.17 Maintenance of Classes and Assigned Characteristics with Transaction CL02

Each class in the SAP system has a class type that describes in which context you can use the class. Table 2.3 shows the class types that are significant in the context of the scenarios described here.

Class Type	Description
001	Classification of material masters
002	Classification of equipment (used here to represent prototypes and parts)
017	Classification of DIRs
025	Classification of change masters
046	Classification of ERs
053	Classification of product structure objects (product families, views, and product components)
056	Classification of product structure objects (product variants, product item variants)

Table 2.3 List of SAP Standard Class Types

Class Type	Description
200	Class, which is used as a class position in a BOM but can also be used to classify material masters
300	Class, which is used for the configuration of products but can also be used to classify material masters

Table 2.3 List of SAP Standard Class Types (Cont.)

Classes can use common characteristics that are important for evaluation in different contexts. The classification system provides the following additional functionalities to facilitate working with classes:

- Overwrite class-specific characteristic values so that all originally defined characteristic values aren't allowed in the context of a class.
- Set up class hierarchies to share characteristics that are valid across several object types to avoid defining the same basic characteristics multiple times. You can achieve this by assigning the shared characteristics to one single class.
- Hide characteristics when their value assignments result from dependencies on other characteristics.

Furthermore, the maintenance of characteristics and classes is subject to SAP change management, which means that changes to the classification system can occur at a specific time in the future. This allows for reasonable advance planning of changes to the characteristics.

2.4.3 Object Classification

The classification system enables the classification of master objects. Therefore, additional information about a master object can be stored to catalog this object and search for it.

Classification can be assigned to master objects is different ways:

- Using the corresponding web screens in SAP PLM (**Change Material** or **Change Document**), as shown in Figure 2.18
- With the master objects transactions (Transaction MM02 for material master; Transaction CV02N for DIRs)

- With the transactions of the classification system (Transactions CL20N or CL24N)
- With the mass maintenance of classification (Transaction CLMM), which is used to maintain the classification of several objects in one step

Maintenance via the web screens has the advantage that the value assignment of the master object takes place directly in the context of its creation or maintenance, and no specific transaction is required.

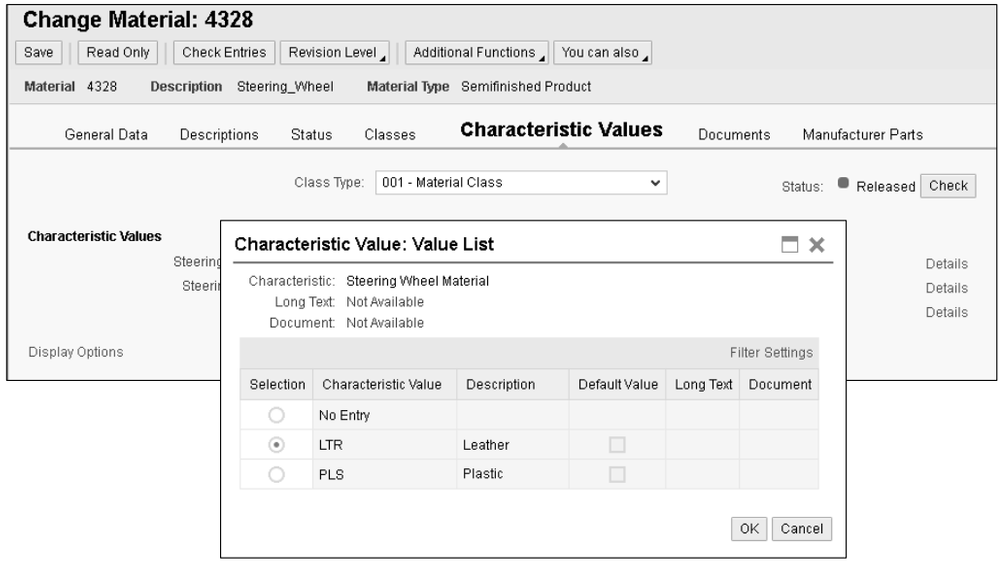


Figure 2.18 Classification of a Material Master

2.4.4 Configuration and Authorization

The configuration settings of the classification system can be found in the IMG under **Cross-Application Components • Classification System** (see Figure 2.19).

You use the following activities:

- **Maintain Object Types and Class Types**
  Classes have a class type that describes the context of their use, as described in Section 2.4.2. For example, Variant Configuration uses class type 300. This customization allows you to influence the behavior of classes (e.g., which tabs are visible for the class, functions, and classification behavior).

- **Define Characteristic Statuses/Maintain Class Statuses**
  You can also define a status for characteristics and classes. For classes, you can carry out the configuration settings for the status per class type.
- **Define Characteristics Groups/Define Class Groups**
  In the class system, you can easily group characteristics and classes, for example, if they share similar content. You define these groups in the configuration settings.

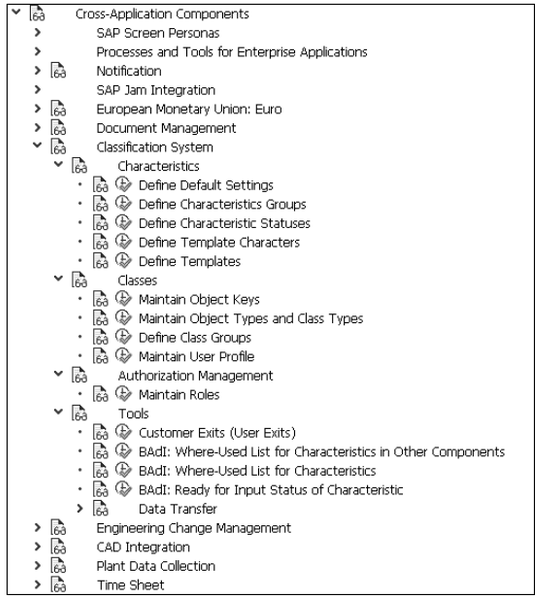


Figure 2.19 Configuration of the Classification System

Some authorization objects allow users to make changes in the classification system. You can bundle them into roles and assign these to the users to provide the respective authorization. Table 2.4 shows some of the most important authorizations of the classification system.

Authorization Objects	Description
C_CABN	General characteristics maintenance
C_CABN_GRP	Characteristics maintenance per authorization group
C_KLAH_BKP	Class maintenance

Table 2.4 Authorizations for the Classification System

You also use the authorization object S_TCODE to authorize the necessary transactions of the classification system (Transactions CT04, CL01, CL02, etc.).

2.5 Object Search

After you've maintained the master objects, you can find them using the object search functionality. A good search for product data helps to avoid the creation of multiple objects and thus improves the data consistency. There are a number of use cases for object search, as follows:

- Find certain material masters, documents, or change measures using known, structured data
- Search by customer-specific classification information
- Search using unstructured information, such as text blocks in long texts or in document originals
- Perform a geometric search using similarly constructed parts
- Search within a product hierarchy, for example, where parts are used

Object search functionality covers many of these search scenarios in standard SAP PLM 7. If you want to expand your search functionality, for example, for specific geometric searches, you can complement the SAP solution with a third-party system. In the following sections, we explain how the SAP PLM 7 search works, which features it provides, and which further solutions SAP provides to search for master objects.

2.5.1 SAP Product Lifecycle Management Search

To search for objects based on textual information, SAP PLM 7 provides search functionality based on *SAP NetWeaver Enterprise Search*. It uses *Search and Classification TREX* or the *SAP HANA search*. You can use search for objects with the following criteria:

- Using normal structured attributes of the master data objects, for example, by status or creator
- Using unstructured information such as long text or document content in a full-text search
- Using the classification of your master data objects as described in Section 2.4.3

Wildcards can also be used, for example, "+" for any character and "*" for any character string. For the classification-based search, it's also possible to search for value intervals. A search can also be performed over the various object types, making the object search functionality a powerful tool.

Figure 2.20 shows a search making use of material classification. After selecting the characteristics and the characteristic values, you perform the search. If you filled in values on several tabs of the search page, a potential hit must fulfill all selected search attributes. The system displays the search hits in tabular form.

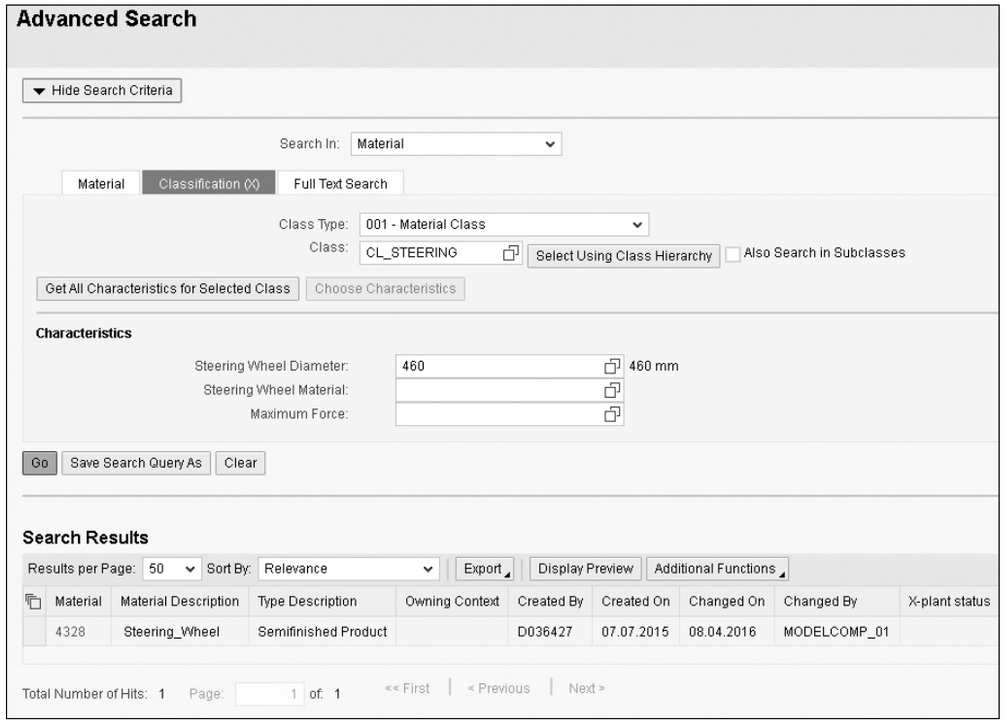


Figure 2.20 Search for Materials with Classification

In addition to searching using the classification and attributes of objects, object search functionality allows a full indexing of the contents of text documents and therefore allows you to search for specific text strings within a file.

The search results provide previews, for example, of a 3D mockup or a drawing thumbnail, giving you an efficient visual identification of the searched document. Figure 2.21 shows an example of the search results in SAP PLM.

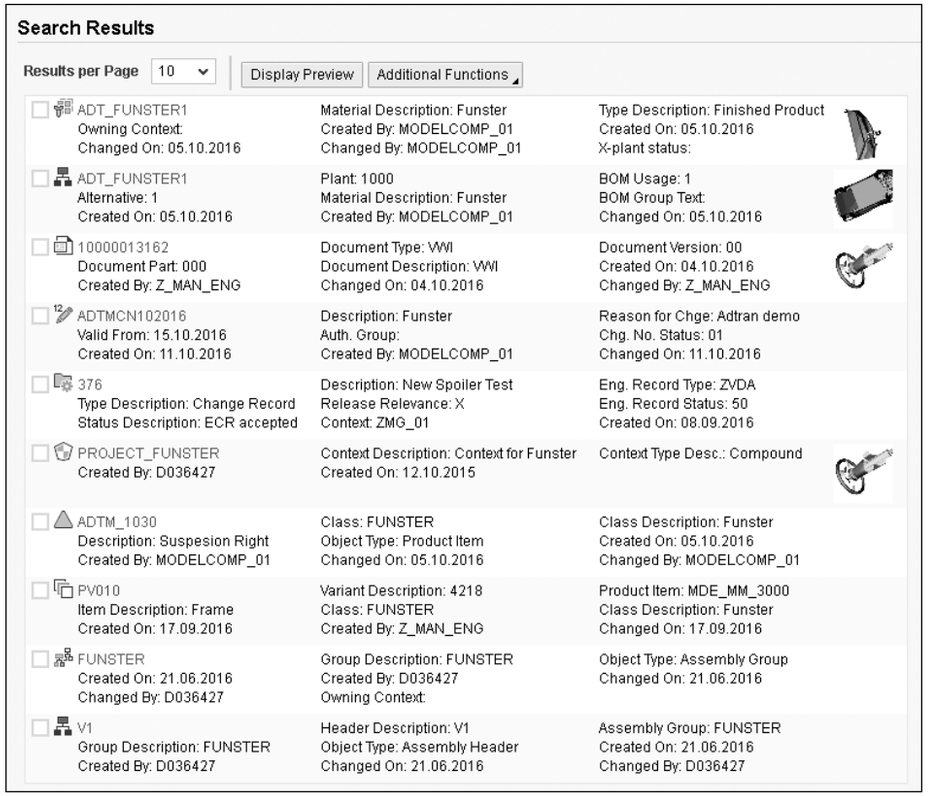


Figure 2.21 Search Results of the Object Search in SAP PLM

You can also perform a fuzzy search. Frequently, when searching for unstructured information, the system might not find all objects because the data quality is low, causing the system not to recognize hits due to typing errors. Using fuzzy search, the system accepts a certain amount of deviation between the search expression and potential hits.

Because SAP NetWeaver Enterprise Search is the basis of the SAP PLM 7 object search, it's possible to add additional objects, dependencies, or customer attributes to the search model as part of an implementation project. However, customer-specific classification attributes are also available without additional model extensions.

2.5.2 Search Administration

For the administration of SAP NetWeaver Enterprise Search, you use Transaction ESH_COCKPIT. Here you get an overview of all search object connectors that you've already activated. Search object connectors are the data sources based on SAP business objects. You can activate further connectors and model new connectors for your customer-specific business objects.

In addition, the ESH Cockpit shows the indexing status of the individual object indexes. You can initiate the first indexing or re-indexing and determine how the system should update the indexes automatically (either immediately or at regular intervals).

2.5.3 Further Search Options

If you don't use SAP PLM 7, you can use the following searches:

- Classification search transactions such as Transaction CL30N for object search for classification or Transaction CT12 for a where-used for characteristics and values in master data objects
- Object-specific search transactions such as Transaction CV04N for searching DIRs using attributes and classification
- Value helps in the master transactions, which also offer extensive attribute and classification searches for material masters or DIRs

2.6 Object Navigation

An important property of product data is the relationship between the individual objects of the product structures. These relationships contain crucial information about the product. Users must be able to see them in the context of product development. Typical use cases include the following:

- Which subassemblies and individual parts constitute an assembly or a material master, and which usages use a certain material?
- What changes have the users applied to an object, and which objects have they changed?
- Which DIR represents the CAD model for a material, and what does it look like? What is the structure of this document?

- What are the structural dependencies, that is, which working steps are required to assemble a particular assembly?

Part of these questions can be answered already via the PSM or BOM display, the object list of the ERs, the search helps, and various standard features. The objective of the object navigation is, however, cross-object and user-friendly navigation in the product data, in which you get from one object to the next. The Object Navigator in SAP PLM and the **Product Structure** browser are two SAP solutions that cover these use cases. The following sections explain the Object Navigator, its features and extensibility, and also cover the **Product Structure** browser.

2.6.1 SAP Product Lifecycle Management Object Navigator

The Object Navigator in SAP PLM 7 allows the following actions from a specific context or start object:

- Retrieve the detail object data, including a visual representation.
- Identify the structure relationships of the objects among themselves (what uses an object, where is the object itself being used), as a multilevel hierarchy.
- Identify the assignment of the product object to authorization contexts.
- Assign ERs and change numbers, that is, with which change measures the objects were changed.
- Display further object-specific information (e.g., the material master shows the manufacturer part numbers).
- Reopen one of the displayed objects if it is relevant for further processing via the Object Navigator to display its dependencies and details or in the relevant maintenance screens of SAP PLM 7.

Out of the box, the Object Navigator supports most SAP PLM objects, including material masters, documents, BOMs, ERs, and change numbers. You can easily include additional objects as part of a customer project, such as the master data objects from SAP ERP Plant Maintenance (PM) (functional location, equipment, maintenance plan, measuring point), QM (inspection lot, certificate), or work scheduling.

Figure 2.22 shows the Object Navigator in the **Structure** view, which is the representation of the substructure of the currently selected **Material FUNSTER**. The substructure is exploded in several levels so that individual components are also visible, which are several levels below the starting material. This multilevel resolution is possible with the product structure as well as with the MBOMs or document structures. You can

influence the structure explosion by suing parameters such as plant, validity date, or BOM priority (through the selection ID).

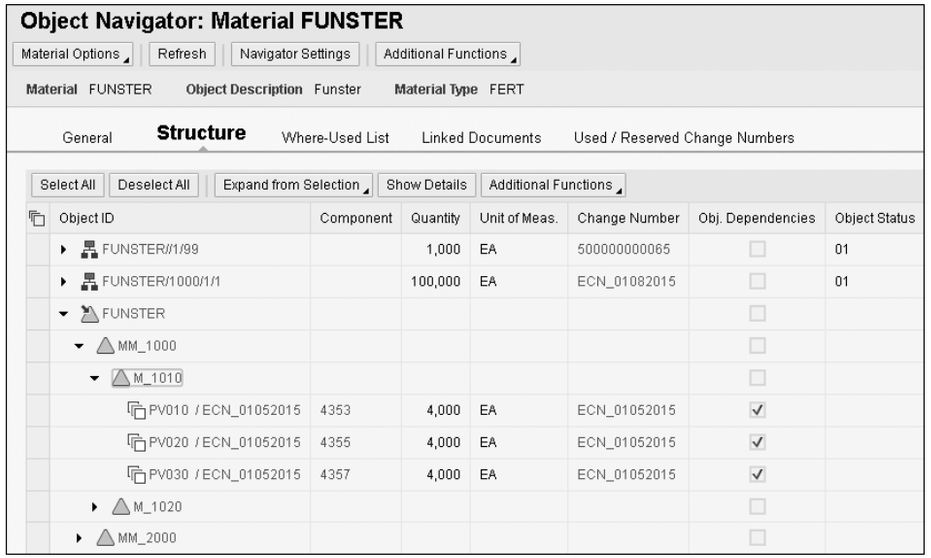


Figure 2.22 Object Navigator in SAP PLM (Structure View)

2.6.2 Object Navigator Configuration and Authorizations

In addition to the object types provided by the standard, you can also link your own object types with your own tabs and relationships in the Object Navigator. The configuration settings of the Object Navigator can be found in the IMG under **Logistics - General • Product Lifecycle Management (PLM) • PLM Web User Interface • Settings for Object Navigator**. You can use these configuration settings to define new layouts for object types, displayed information, appearance of tabs, and much more.

You can also link non-SAP objects or objects from other SAP systems in a cross-system approach. For example, you can search in a plant-specific SAP ERP system for a plant BOM that uses a specific material master. Integration with SAP Portfolio and Project Management (SAP PPM) is possible even if SAP PPM runs a separate system. Both systems can access the object types of the other system. To do this, assign the corresponding logical systems to the existing object type definitions.

Table 2.5 shows the authorization for the Object Navigator.

Authorization Object	Description
PLM_LAYOUT	Controls the visibility of the views in the Object Navigator

Table 2.5 Authorization for the Object Navigator

2.6.3 Object Navigation with the Product Structure Browser

If you don't use SAP PLM 7, the **Product Structure** browser allows a similar operation. You can access it via Transaction CCO4 as well as via the menus of the individual master data object transactions.

The **Product Structure** browser doesn't display the individual object dependencies across multiple tabs, but it structures them as a tree with parent and child relationships for each dependency type. Here, you begin with a start object that represents the root of the tree. To get detailed data on the object, you can either navigate to the master transaction or use the icons in the columns of the tree to call specific transactions. Figure 2.23 shows a view of the **Product Structure** browser.

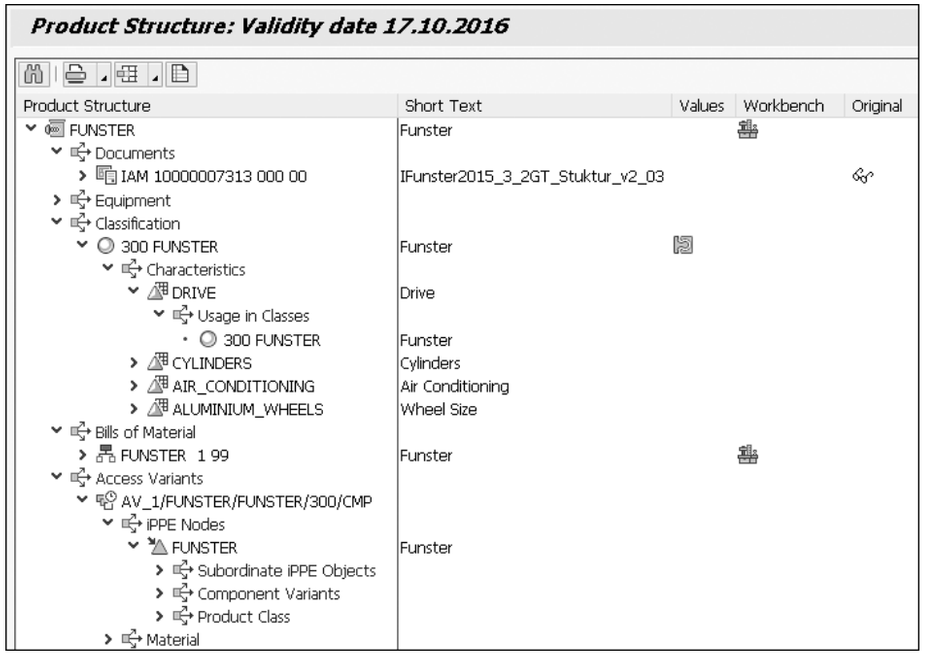


Figure 2.23 Product Structure Browser

The **Product Structure** browser offers a wider range of standard business objects for visualization (e.g., also for objects of PM, classification system, and routings).

The **Product Structure** browser is an integrated part of the SAP solution landscape. You'll often use it to select structures, for example, in the export interface of cFolders, in the STEP interface, and in many other places. In addition, many transactions offer links to the **Product Structure** browser to supplement the hierarchical overview with informational details.

2.7 Summary

In this chapter, we've shown the following:

- Critical business objects in the product lifecycle and how they interact with each other
- Material management in SAP with the material master as a central business object
- SAP DMS to manage any content of the product lifecycle, such as manuals, design models, and so forth
- Classification system, which forms the basis of variant configuration and makes it possible to catalog business objects by means of object classification
- Cross-application features such as object search and navigation, allowing users to easily find and use the business objects needed for tasks in the product development process

Contents

Index

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

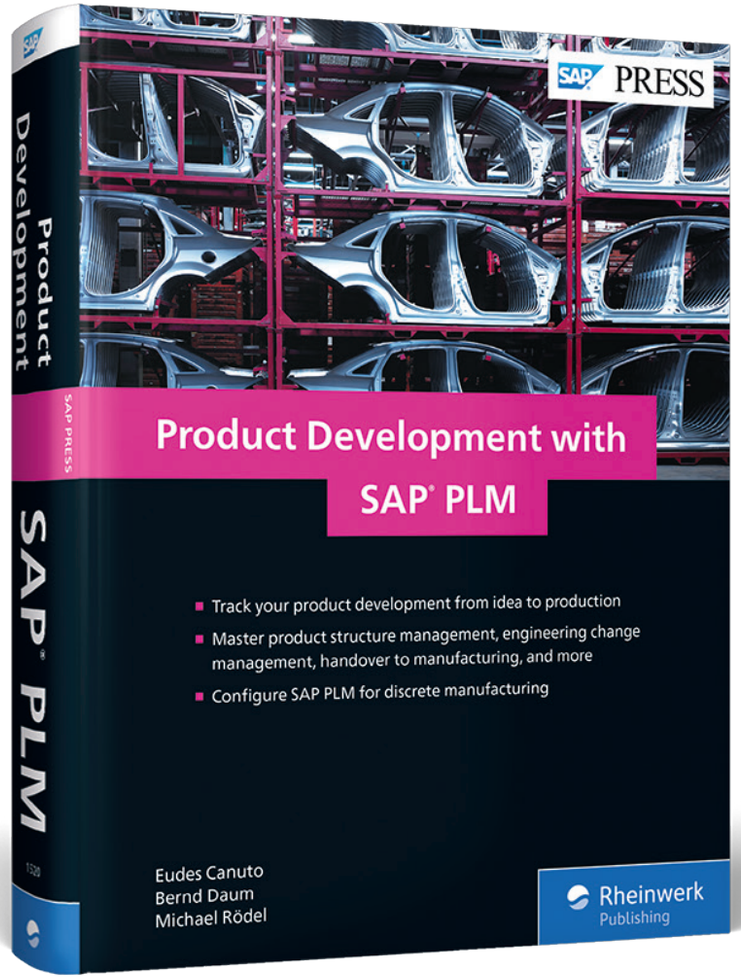
U

V

W

X

Z



Eudes Canuto, Bernd Daum, and Michael Rödel

Product Development with SAP PLM

727 Pages, 2014, $89.95
ISBN 978-1-4932-1520-1

www.sap-press.com/4363

Eudes Canuto joined SAP in 2010 in the area of SAP PLM consulting as a business development manager based in Chicago, Illinois. Mr. Canuto is the SAP PLM practice lead for the R&D/engineering team in North America, leading the business development activities for the services organization. In addition, Mr. Canuto is responsible for the concept and build of the SAP Model Company for R&D/engineering and sustainability and has contributed to the development of the SAP PLM standard solutions.

Dr. Bernd Daum joined SAP in 2001 in the area of SAP PLM consulting; he is primarily active in the automotive and mechanical engineering industries. After joining SAP AG, he was responsible for product structure and change management implementation projects in major OEMs in the automotive industry. Since the introduction of SAP PLM 7.0, he has helped customers in different industries as a solution architect, and has played a key role in building the SAP Model Company for R&D/engineering.

Michael Rödel has been working in different SAP PLM roles at SAP since 2004. After graduating with a degree in information systems at Leipzig University, he worked in development for Integrated Product and Process Engineering (iPPE) and SAP PLM 7.0. In his role as a solution architect, he has supported numerous SAP customers in the automotive industry, implementing product development solutions and establishing an SAP portfolio of PPM consulting solutions.